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# **WIRELESS ALARM SYSTEM USING AVR MICROCONTROLLER**

Submitted by

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# **WIRELESS ALARM SYSTEM USING AVR MICRONTROLLER**

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*in*

***Electronics and Instrumentation Engineering***

*By*

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*Under the guidance of*

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## **CERTIFICATE**

This is to certify that the Thesis Report entitled WIRELESS ALARM SYSTEM USING AVR MICROCONTROLLER submitted by Nivedita Sethy (109EI0344) of Electronics and Instrumentation Engineering during May 2013 at National Institute of Technology, Rourkela is an authentic work performed by her under my supervision and guidance. To the best of my knowledge, the matter embodied in the thesis has not been submitted to any other University / Institute for the award of any Degree or Diploma.

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National Institute of Technology, Rourkela

Department of Electronics and Communication Engineering

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Nivedita Sethy

109EI0344

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## ***ABSTRACT***

The main aim is to design a wireless alarm system using AVR microcontroller. This alarm system had a force sensor as its main component. The force sensor senses the force or pressure and then it create a sound which can make a person to avoid problems. This alarm system is used for the home security to detect presence of intruders getting into the home. A servo motor is also installed here this shows the automatic movement of motor which is implemented for automatic control of the gate. So, we are designing a wireless alarm system which also acts as an alarm system and also for automatic barrier control. This doesn't occur at a time a certain time has been kept by using time delay.

# ***CHAPTER 1***

## ***Introduction***

*Introduction and motivation*

*Literature review*

*Chapter wise organisation of the thesis*

*Summary*

## 1.1 Introduction and motivation

In this 21<sup>st</sup> century almost all the advanced things in the world are made using electronics as it's basic component. Though the ideas are old but renewal of the system is due to the replacement of the base part of the system by an electronics system. This world is now full of the electronics substances because almost every substance in this world has atleast a small part of electronics substance. There are many things in this world which is very special to particular person it can be due to cost or importance. So, we need to protect that thing from the exposure of bad environment for which we install an alarm system.

An alarm system is needed to prevent any bad condition or situation which we don't want to face. When alarm device is installed then we can avoid unsuitable circumstances as we can use a fire alarm, antitheft alarm device etc. So we need an alarm system which can be implemented for antitheft purpose. We will also implement in the automatic gate control. We will design a wireless alarm system having a feature of automatic gate control also which can achieved by using a servo motor. The servo motor will control the barrier or gate which is need to open when a vehicle comes and close it after a certain time.

## 1.2 Literature review

An alarm device or system gives an audible, visual or any other form of signal during a problem or any unavoidable circumstances. They are often connected with a buzzer or siren. They have a capability of causing a fight or flight response in humans. In this condition a person will panic and either flee the perceived danger or attempt to eliminate it. Intruder alarm systems can be integrated with flood, gas and smoke detectors to be used for functions such as gas leak, flood and fire detection. And then it will be possible to call for an ambulance or call the fire station directly with the panic button in any emergency. In a paper an alarm system has been described.

An alarm device comprises a blocking oscillator circuit composed of a transformer and a transistor and a sound emitter using a piezoelectric effect exhibiting element and interposed between one end of the secondary coil connected to the base of the transistor. When the sound emitter receives a slight vibration, it generates an electromotive force which is applied to the base of the transistor. Consequently, the blocking oscillation circuit oscillates and causes the sound emitter to issue an alarm.

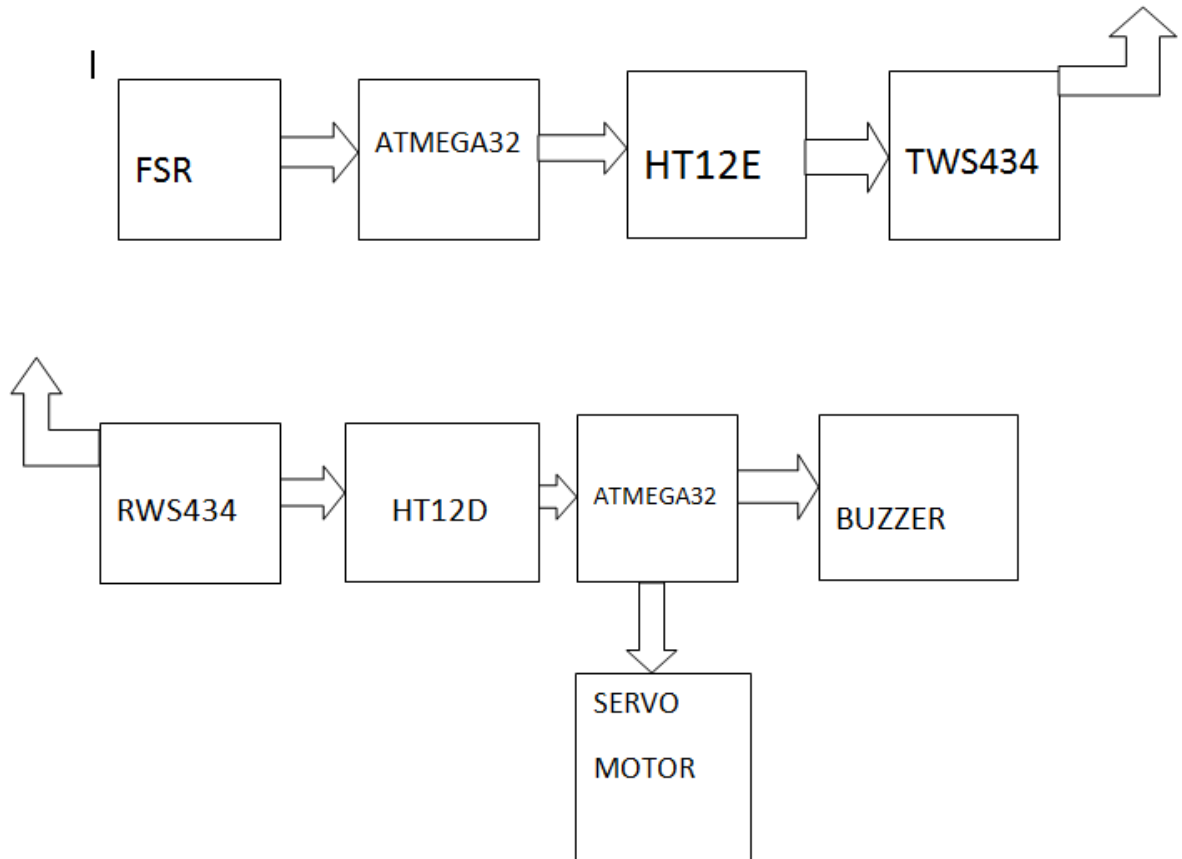
As the above paper described and some papers referred it is known that we need to use a sensor which will sense or detect the condition which is unavoidable and the alarm gives a sound which make us realise that there is something wrong over here. After hearing the alarm sound we can take the precautions needed and we can protect ourselves from the problem.

## 1.3 Objective

The objective of my project is to design an wireless alarm system, that will possess built in buzzer sound facility even if it is outside the home. This will enable a person to know that he should be alert. The buzzer alerts help him in detecting the presence of intruders getting into the house even when he will be in deep sleep.

In this wireless system we will also use a servo motor which can be implemented in automatic control of gate. The wireless system also counts the number entering into the gate. This servo motor will be handled by using a code and it will operate automatically.

All of the operations to be done by this system is handled by the software part in which we write specific code for the specific operations.



**Fig 1.1.:- Functional block diagram of the system**

## 1.4 Chapter wise organisation of the thesis

**Chapter 1- Introduction:-** This chapter describes the introduction and motivation of this project and also the objective of it. This chapter also includes the literature which I have referred.

**Chapter 2- Sensor:-** This chapter describes the various sensors mostly the pressure sensor and force sensor. In this chapter the properties of pressure sensor and force sensor are also included.

**Chapter 3- Force Sensitive Resistor:-** This chapter describes the features and the properties of the force sensitive resistor used in this project.

**Chapter 4- RF module:-** This chapter describes the components of the RF module. The properties of the transmitter and receiver are described. The chapter also gives the information about the connection of the RF module with encoder and decoder.

**Chapter 5- AVR Microcontroller:-** This chapter describes the features of the AVR microcontroller. This includes the software part or coding part of the project.

**Chapter 6- Output components:-** This chapter describes the output components i.e. the components shows the output –Buzzer and Servo motor.

**Chapter 7- Hardware implementation:-** This chapter show the hardware part of the project. This shows the circuit design of the alarm system and the automatic control of the servo motor.

**Chapter 8- Summary and Conclusions:-** In this chapter, the final conclusions and summary of the project is presented.

## **1.5 Summary**

In this introductory chapter, brief description of the alarm system and the wireless techniques, the motivation towards the hardware implementation rather than the software solution of the product has been summarized. Literature review of previous papers has been described. Finally there is summary of chapter wise distribution of the thesis.



# CHAPTER 2

## *Sensors*

*Introduction*

*Types of pressure sensors*

*Force sensor*

*Conclusion*

## **2.1 Introduction**

A sensor is a device which receives and responds to a signal when touched or sensed. When the measured quantity changes this change the output of the sensor the rate of change is called as the sensitivity of the sensor. Sensor is also called detector because it detects the signal which is applied. Devices which perform an input function are commonly called sensors because they sense a physical change in some characteristic that changes in response to some excitation. Devices which perform an output function and generally called actuators which are used to control some external device. Both sensors and actuators are collectively known as transducers because they are used to convert energy of one kind into energy of other kind.

**Table 2.1 Common Transducers**

Quantity being measured	Input device (sensor)	Output device ( actuator)
Light level	LDR, Photodiode, Phototransistor, solar cell	Lights and lamps, displays, LEDs and Fibre optics
Temperature	Thermocouple, Thermistor, Thermostat, RTD	Heater, Fan
Force or pressure	Strain gauge, pressure switch, load cells	Lifts and jacks, electromagnets, Vibrations
Position	Potentiometer, Encoders, LVDT.	Motor, Solenoid, Panel meters
Speed	Tachogenerator, Doppler effect sensors	AC and DC motors, stepper motor, brake
Sound	Carbon microphone, piezoelectric crystal	Bell, buzzer, loudspeaker

## 2.2 Types of pressure sensors

There are many types of pressure sensors. It is mostly classified on the basis of type of measurement it does. The pressure sensors also vary due to the manufacturing material of the sensor. Some of the pressure sensors are briefly described over here.

Potentiometric pressure sensors use a capsule or bourdon tube to drive a wiper arm on a resistive element. These have repeatability and hysteresis errors. These devices are of low cost and are used in low performance applications. Inductive pressure sensors are based on varying inductance or inductive coupling are used. These all require AC excitation of the coil. Capacitive pressure sensors typically use a thin diaphragm as one plate of the capacitor. When pressure is applied the diaphragm deflects and the capacitance changes. Piezoelectric pressure sensors are bi-directional transducers capable of converting stress into an electric potential and vice versa.

## **2.3 Force sensor**

The force sensors are the sensors which detects or sends a signal when a force is applied. It is quite similar to that of pressure sensor. Force sensor is defined as the sensor which convert the input mechanical force into the output electrical signal. There are many advanced version of force sensors found nowadays.

## **2.4 Conclusion**

This chapter labels the various types of sensors and give brief idea about the force sensor and pressure sensor which we are going to use as a base element.

# CHAPTER 3

## *Force sensing resistor (FSR)*

*Introduction*

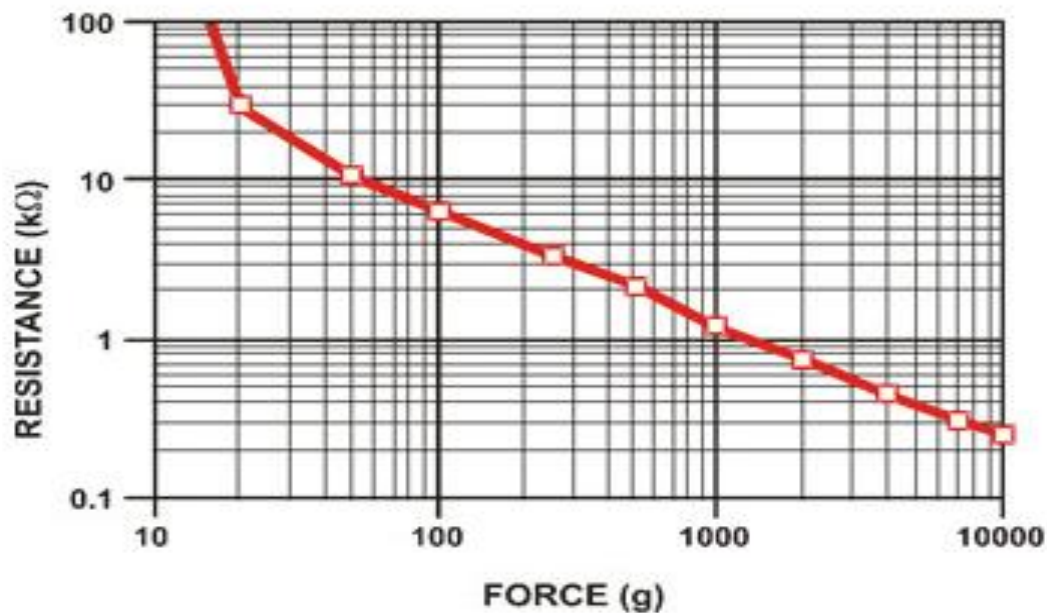
*Testing of FSR*

*Connection of FSR*

*Conclusion*

### 3.1 Introduction

FSRs are sensors that allow us to detect physical pressure, squeezing and weight, They are available in low cost and very simple to use. The small half inch diameter round part is the sensitive bit which senses the change in force or pressure applied. The FSR is made of two layers but they are separated by a spacer. The more is the pressure applied the more of those active element touch the semiconductor and the resistance decreases. FSR's are basically a resistor that changes its resistive value (in ohms  $\Omega$ ) depending on how much it is pressed. These sensors are mostly cheap as well as easy to use but are rarely correct. They also vary some from sensor to sensor perhaps 10%. So basically when you use FSR's you should only expect to get ranges of response. While these FSRs can identify weight, they're a poor choice for detecting exactly how many pounds of weight are on them.



As previously stated, the FSR's resistance varies with further application pressure. In absence of pressure, the sensor seems like an infinite resistor i.e. open circuit, with an increase in pressure, the value of resistance reduces. This graph specifies approximately the value of resistance of the sensor at different force measurements. It is important to notice that the graph isn't really linear and that at especially low force measurements it quickly goes from infinite to  $100\text{K}\Omega$ .

## 3.2 Testing of FSR

The simplest way to determine how the FSR works is to connect a multi-meter in resistance measurement mode to the two tabs on the sensor and see how the resistance varies. As the resistance changes a lot, an auto-ranging meter works well here. Or else, just make sure to try different ranges, between 1 Mohm and 100 ohm before 'giving up'.

**Resistance range:** Infinite/open circuit at no pressure,  $100\text{K}\Omega$  at light pressure to  $200\Omega$  at maximum pressure.

## 3.3 Connection of FSR

FSRs are basically resistors so, they are non-polarized. That means we can connect them up either way and they'll work just fine! FSRs are often a polymer with conductive material silk-screened on. Which means that they're plastic as well as connection tab is crimped



on slightly delicate material. Thus the ideal way to connect to these is to merely plug them into a breadboard or use a clamp-style connector like alligator clips, or a female header or a terminal block.

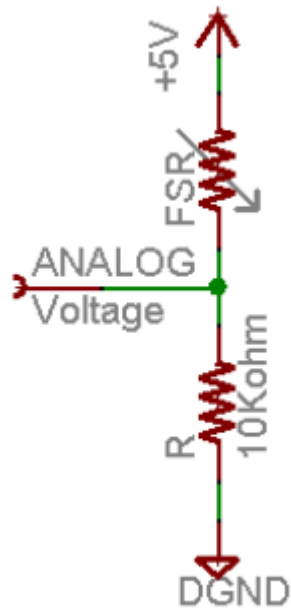


Fig 3.1: connection of FSR

### 3.4 Conclusion

This chapter describes the features of the force sensing resistor. The testing and connection is also known.

# ***CHAPTER 4***

## ***RF Module***

*Introduction*

*Transmitter connection*

*Receiver connection*

*Conclusion*

## 4.1 Introduction

As we are designing a wireless alarm system we will definitely need a pair of transmitter and receiver. The transmitter and receiver pair is the basic need for any wireless device or system. As the name suggests, the RF module operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, all the digital data is characterized as changes in the amplitude of carrier wave. This type of modulation is referred to as Amplitude Shift Keying (ASK).

Transmission through RF is better than IR (infrared) because of several reasons. First of all, signals through RF can travel through larger distances making it suitable for long range applications. Moreover, while IR mostly operates in line-of-sight (LOS) mode, RF signals can travel even if there is an obstruction between transmitter & receiver. Further, RF transmission is stronger and more reliable than IR transmission. RF communication uses a particular frequency unlike IR signals which are affected by other IR emitting sources. This **RF module** consists of an **RF Transmitter** and an **RF Receiver**.

## 4.2 Transmitter connection

In this part of the RF module we will discuss about the connection of RF transmitter TWS434 to the encoder HT12E. The encoder HT12E encodes the signal obtained from the AVR microcontroller

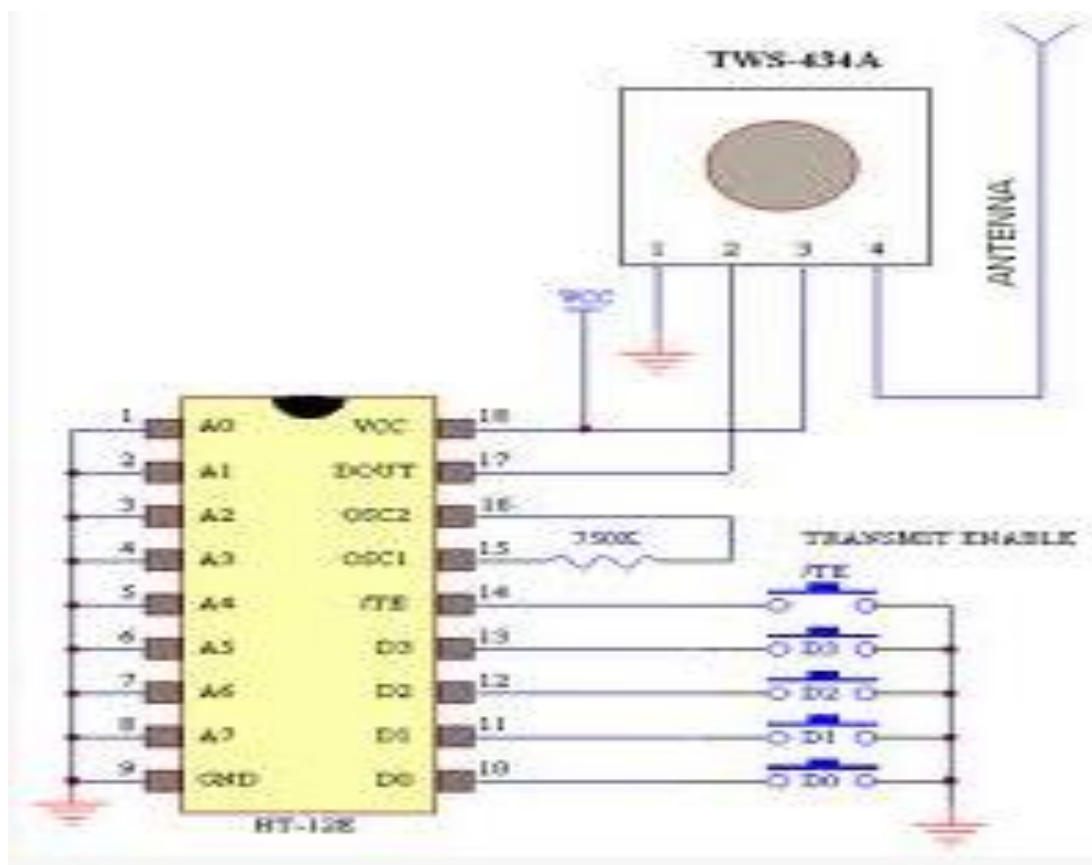
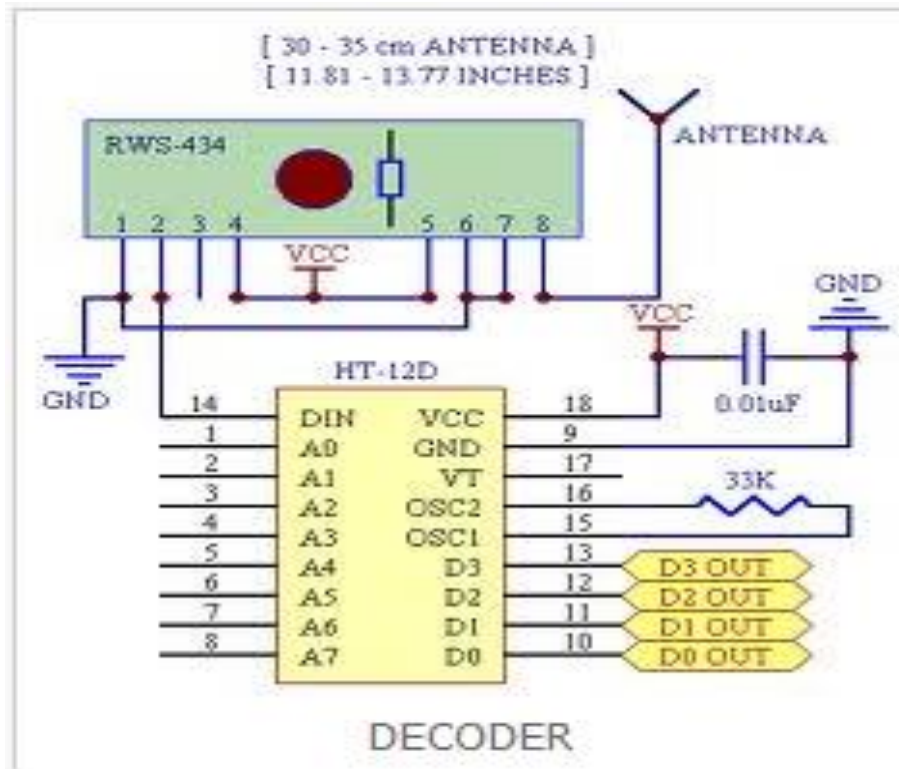


Fig 4.1. RF Transmitter

### **4.3 Receiver connection**

In this section the RF receiver is connected to the decoder HT12D. The data we had received from the RF receiver need to be decoded for further outputs needed. There is a capacitor connected between the vcc and ground to maintain the voltage difference between them.

**Fig 4.2: RF receiver**



## 4.4 Conclusion

This chapter defines the features and connection RF module for wireless transmission and receiving purpose.

# **CHAPTER 5**

## **AVR Microcontroller**

*Introduction*

*Features*

*Hardware and software*

*Conclusion*

## 5.1 Introduction

The AVR is a modified Harvard architecture 8 bit RISC single chip microcontroller which was developed by Atmel in 1996. The AVR microcontroller was one of the first microcontroller families to use on chip flash memory for program storage. The AVR is a modified architecture of Harvard machine where program and data are stored in separate physical memory systems that appear in different address spaces, but have the ability to read the data items from the program memory using certain instructions.

We are using an AVR trainer Board over here which contains a ATMEGA32 avr microcontroller. We use a microcontroller because it is programmable, a code typically written in C decides what it does. It is easier to write a code than design and make a custom circuit for complex jobs. The same can be used in hundreds of applications.

## 5.2 Features

- High performance, low power 8 bit microcontroller
- Advanced RISC architecture
- Non-volatile program as well as data memories



- On chip analog comparator
- 8 channel, 10 bit ADC
- 32 programmable I/O line
- Low power consumption
- 32Kb of programmable flash memory

### **5.3 Hardware and Software part**

Software used for AVR microcontroller are AVRStudio and Winavr. In this software part the code is written and the compiled.

Hardware used here is the AVR programmer board and the application board.

In this part we can get output and these can be involved to get some result.

Fig 5.1:- AVR Trainer board used



## 5.4 Conclusion

This chapter labels the feature and hardware and software part of the avr trainer board used here for designing the device.

# **CHAPTER 6**

## **OUTPUT COMPONENTS**

*Introduction*

*Buzzer*

*Servo motor*

*LED*

*Conclusion*

## **6.1 Introduction**

The output components are the components which can be used for detection of the output. These components help us to know the status of the output. They can be available in the same AVR trainer board or can be connected externally. The circuit we have designed or the system we have designed we have three output components. They are buzzer, servo motor and the LED.

## **6.2 Buzzer**

The buzzer is present in the same AVR trainer board. This buzzer makes sound when the force is applied to the force sensitive resistor. This acts as an alarm system and it is connected through the RF module so it can be called as wireless alarm system. When some force is applied to the force sensitive resistor the signal is transmitted to the receiver and the buzzer makes sound which serves as an alarm. The alarm blows for 2 sec and then it is off.

### **6.3 Servo motor**

Servo motor is a rotary actuator that allows for precise control of angular position. It comprises of a motor coupled to a sensor for position feedback, through a reduction gearbox. This servo motor is externally connected to the AVR microcontroller to get the output. When the buzzer is off the servo motor starts rotating and remain open for 5 sec and then it closes.

### **6.4 LED**

There is a strip of LED present in the AVR trainer board. When this LED works as a counter and it shows how many times the force is applied to the force sensitive resistor. When we switch on the reset button the counting starts from the beginning.

### **6.5 Conclusion**

This chapter labels the outputs we get from the components we had connected to detect the signal and count the output.

# CHAPTER 7

## Hardware Implementation

*Introduction*

*Hardware model*

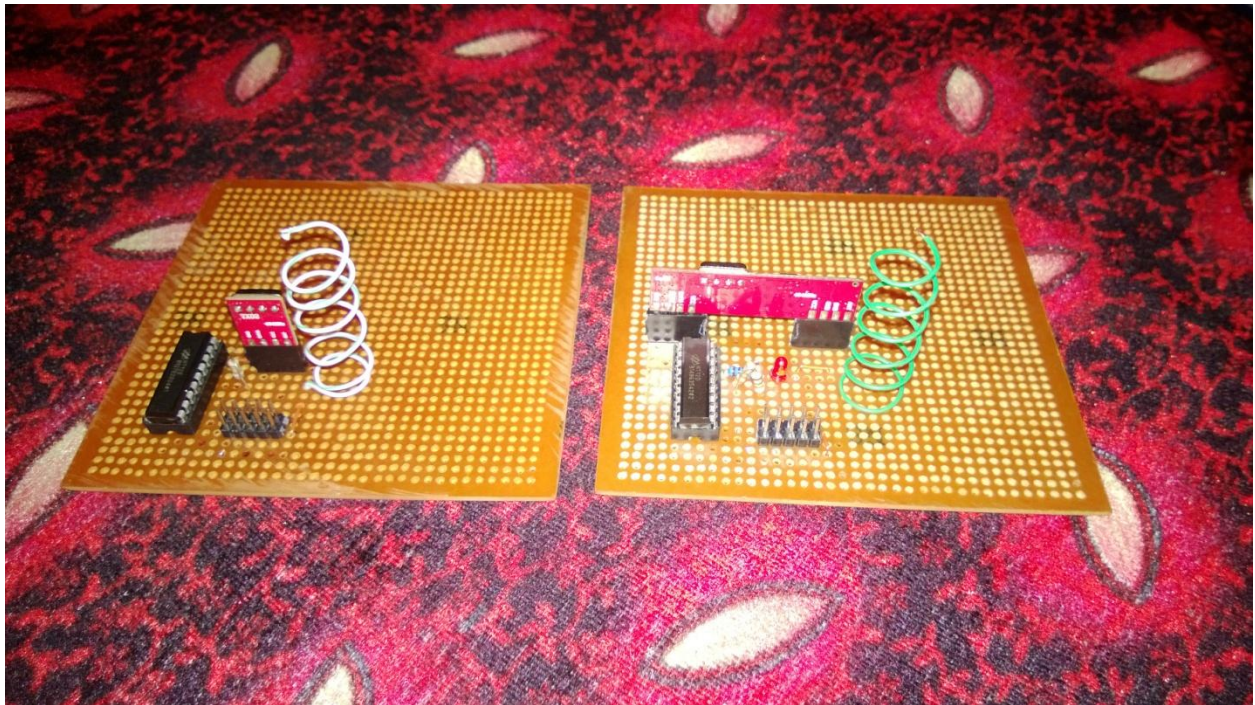
*Working*

*Conclusion*

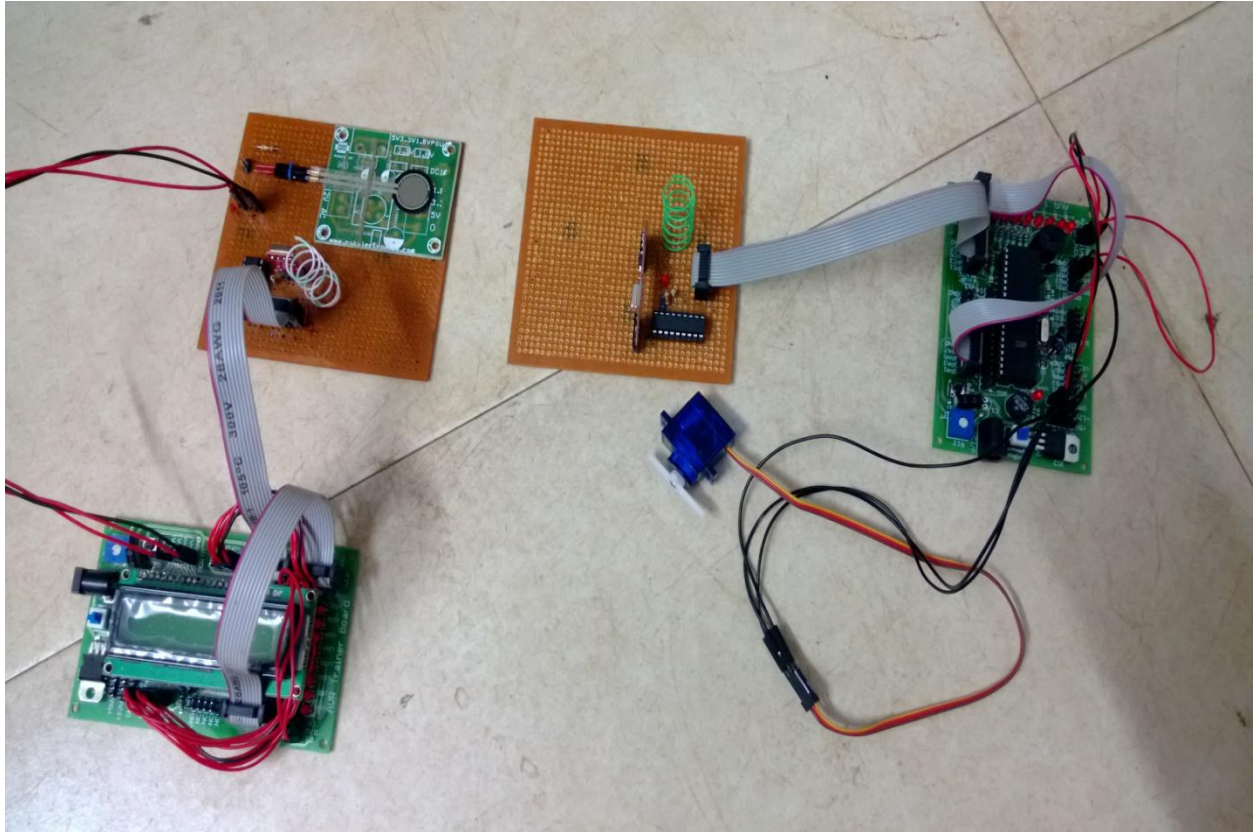
## 7.1 Introduction

The programs or codes are executed and compiled. These codes are dumped by using a program burner and it is dumped into the microcontroller. Then the hardware section of the system does the work. Hardware implementation is the hardware section of the system and the output we get in that.

## 7.2 Hardware model



**Fig 7.1 :- RF module**



**Fig 7.2 :- wireless alarm system with servo motor**



### **7.3 Working**

When a force is applied to the FSR the transmitter will transmit the signal to the receiver. After receiving a signal the buzzer will start and stop after blowing for 2 sec. Then the servo motor starts rotating and remain open for 5 sec and then it will close. The LED present over there counts the number of times FSR has been applied pressure.

### **7.4 Conclusion**

This chapter ss the designed hardware model of the wireless alarm system using avr microcontroller and the servo motor placed there which can be implemented for automatic control gate opening and closing.

## **CHAPTER 8**

### **Summary and conclusion**

In this thesis the wireless alarm system is designed using AVR microcontroller. This shows the expected output. It includes the operation of servo motor due to the force sensor. By using this alarm system we can protect our homes from intruders. Even if the owner of the house is in deep sleep he can know someone is getting into the house through window. The signal from the window get transmitted to the bedroom and the owner can know. The operation of the servo motor gives us another application. It will show the automatic control of gate. When any vehicle comes the gate opens and it remain open for 2 sec and then gate will close. The use of AVR microcontroller reduces the complexity of the circuit.

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